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ABSTRACT

In 1972 the Beaverton, Oregon, School District adopted a diagnostic-prescriptive instructional model as part of its teacher evaluation plan. To help teachers with the construction and analysis of diagnostic tests, the district made three data processing services available: (1) test item analysis, (2) test scoring and summarization, and (3) data storage and retrieval. The test analysis program determined scales of test item difficulty and evaluated the discriminatory power of test items. Options provided by the test scoring service include reporting test results by teaching objectives, comparison of results with mastery criteria, and providing group distributions and other descriptive statistics. The programs were developed on a 20K storage computer with an Opscan 17 scanner as the primary input mechanism. Software was written in Fortran II with a package developed specifically for the Digital Equipment Corporation PDP-8 machine. Evaluation of the effects of the data analysis programs in three years of a 9th grade writing course showed some evidence of student improvement in meeting course objectives. An appendix contains samples of test forms and computer printouts. (KB)

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A COMPUTER SUPPORT SYSTEM FOR A TEACHER EVALUATION MODEL

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by:

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Beaverton (Oregon) Schools

Paper Presented at NAUCAL
National Conference

October 28, 1976

Portland, Oregon

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A COMPUTER SUPPORT SYSTEM FOR
A TEACHER EVALUATION MODEL

In 1972 the Beaverton (Oregon) School District adopted a teaching model that they intended to use as a standard for evaluating teachers in the district. This model includes the following major areas:

1. Diagnosing student strengths and weaknesses.
2. Prescribing instructional alternatives for the diagnosed weaknesses
3. Facilitating the learning process.
4. Evaluating student performance.

This is a classical test-teach-test instructional model. Some of the standards established for this model were:

Diagnosing

1. The competent teacher establishes procedures for gathering data.
2. The competent teacher interprets diagnostic data ot identify the needs and concerns of both the individual and the group.

Prescribing

3. The competent teacher utilizes diagnostic data to establish instructional objectives and relate these to individual needs.
4. The competent teacher plans lessons to meet individual and group needs.

Facilitating

5. The competent teacher utilizes knowledge of subject matter.
6. The competent teacher uses effective classroom management techniques.
7. The competent teacher applies learning theory.
8. The competent teacher uses a variety of instructional techniques appropriate to the students' needs.

Student Performance Evaluation

9. The competent teacher establishes procedures for assessing student performance.

10. The competent teacher interprets the results of student performance assessment.

11. The competent teacher utilizes the results of student performance assessment.

These standards are by no means unique. Many of them have been used by teachers for many years. What this system has done is to focus everyone's attention on a common set of expectations and a beginning point for discussion of teaching strengths and weaknesses.

The areas where teachers have had the most difficulty in the past has been in the diagnosing and prescribing areas. Not because they haven't worked on these areas, but because the tools they've had to work with have not been very good. In particular, the means for gathering data about students to plan instructional programs has not been very good. Some of the problems that have been encountered include:

1. Valid tests for gathering data.

2. Means to summarize data so that it can be easily interpreted in order to diagnose student or group needs.

3. Means to manage data so that it is easy to determine where a student's or classes' next area of instruction should be.

4. The time required to handle the data that is needed.

Most of these problems can be handled using some type of sophisticated data handling system, such as a computer. As we worked with teachers to overcome some of these problems, it became apparent that the computer could be a useful tool to help them in their diagnosis and prescription activities. In order to overcome these problems, we developed the following programs:

1. Item analysis programs for analyzing the tests teachers use to determine if the items are valid.

2. Test scoring programs in order to summarize data for teacher use in diagnosing students.

3. Data storage and retrieval programs for managing the results of the tests.

Item Analysis

The item analysis programs provide item statistics related to the difficulty of the item and the discrimination power of items in distinguishing between students who are able to perform well in a subject from those who do not perform well. In determining the difficulty of an item we use a technique called a Rasch item analysis that converts the percentage correct of an item to an interval scale of difficulties. This procedure will come up with the same scale regardless of the students who took the test.

For item discrimination we use three possible techniques. One procedure is a Point-Biserial correlation, that determines if a student's score on an item correlates well with the total test score. The second technique is related to the Rasch item analysis that again determines if the students' performance on an item corresponds to their performance on the total test. It calculates this correspondance in a different way from the Point-Biserial correlation. The third technique takes the placement of a student in a class or course, as determined by the teacher, and identifies items that will verify their placement. The last technique is used mainly with tests that are intended to serve as placement tests. These techniques have proved to be very valuable in improving the tests that teachers have developed for their programs.

Test Scoring

In order to describe the test scoring procedures, first let me describe the type of tests we use. All tests are constructed around a set of goals or objectives determined by teachers for their subject

area. Some tests cover a series of objectives and are referred to as survey tests. Others are short tests that cover an individual objective. The system is set up to handle either type of test. In addition, for some of the tests, teachers have established definite criteria for mastering the objectives. These tests are usually related to sequential skills, there students need to master certain skills in order to progress onto other skills.

In order to provide useful data related to the tests described, the following options are provided in the system:

1. The results are reported by objective.
2. The results can be compared to a criterion to determine student mastery or a simple percentage correct can be reported on each objective.
3. The results are summarized for the group being tested according to the average percent correct for the group and the distribution of student responses to each question.

(See Appendix A for copies of these printouts.)

It is possible for teachers to take this information and identify the strength and weaknesses of individual students or of the entire class. They can then determine where they want to place emphasis in their work with individual students or the class. In essence they can use the information to assist in diagnosing and prescribing.

Information Storage and Retrieval

For teachers who have established criteria for mastery of tests related to their objectives it is possible to store the pass/fail information. The information on file can be requested by the teacher upon request. This inforamtion is currently being used for purposes of reporting to parents and passing the information from one teacher to the next.

It is possible to update student records without using the test scoring option. The input is through a special scan sheet that allows specific objectives to be updated as either pass or fail. This scan sheet includes the number of each objective and a bubble for recording pass or fail on the objectives.

Computer System

These programs have been developed on Digital Equipment Corporation PDP-8 computer with 20K core storage. It has a 1.2 million byte disc pack and dec-tape. The primary input device is a Opscan 17 scanner that is directly interfaced with the computer. All tests are scanned on this scanner for input. The system also has a card reader that is used for building master files, key files, etc. Output is provided through a 300 line/minute printer.

Software for the system has been written in Fortran II with a custom software package that was developed for this machine.

At the current time the system is a batch system, where teachers must send the scan sheets to the computer center, where they are processed and then the reports are sent to the schools. The computer center has special mail bags to transport the scan sheets and reports back and forth. This facilitates the transfer of mail and allows for 24-48 hour turnaround time.

Identifying information of the student is pre-printed on the scan sheet to reduce the number of errors in filling out the scan sheet by students.

Current Areas

We are currently using this system to assist teachers in the areas of:

1. Elementary Reading (6 schools)
2. Elementary Math (2 schools)
3. Junior High Math (4 schools)
4. Junior High Writing (4 schools)
5. Junior High Science (1 school)
6. Junior High Library Skills (1 school)
7. High School English (1 school)

Not all of these schools are using all options of the system. The elementary reading program is using all components of the system. We intend to expand this program to all elementary schools in the district. One of the problems of using this system has been with the readiness of teachers in terms of their understanding of the teaching model and their commitment to it as an effective approach to instruction. Consequently, it is necessary to spend time prior to or concurrent with the introduction of the system in inservicing teachers on how the system can work for them. This requirement means the system must grow at a controlled rate rather than bringing everyone on at once.

What Differences Has It Made

In one of the programs where we have worked with teachers for three years, we have found some interesting results. A summary of these results is included in Table 1. The program was a writing course for grade nine in one of our junior high schools. As can be seen in Table 1, for the last three years there has been an increase in gain for students in seven of the 12 objectives in the course. At the same time four of the objectives showed a decrease in gain for the same time period. However, students came in at a higher level on these four objectives than when the program began. The increase in gains are coming in the areas where students were the lowest to begin with, possibly indicating an improvement in the instruction related to those objectives.

We are currently working with other schools to evaluate improvements

TABLE 1

MEADOW PARK WRITING TEST RESULTS
FOR 1973-74, 1974-75, and 1975-76

Grade 9

	1973-74		1974-75		1975-76	
Objective	Pre	Post	Pre	Post	Pre	Post
1	29%	30%	33%	46%	40%	52%
2	37	39	40	48	35	47
3	33	44	34	54	35	59
4	40	45	41	42	58	54
5	45	56	33	39	48	46
6	34	58	28	57	34	61
7	22	46	70	80	73	68
8	65	66	52	54	60	82
9	51	41	35	48	46	63
10	35	48	44	50	52	52
11	37	59	38	57	36	68
12	40	50	41	54	30	67

in their programs after using the computer support system to help them diagnose and evaluate students.

Possible Additions

As users grow with the system, we hope to provide additional reports, etc., that can help teachers with their problems as they work on these areas. Some of these additions will obviously evolve as people see additions that can benefit them. However, we have identified some additions that are planned for the future. These additions include:

- A series of reports that would indicate how students at a grade are performing on the objectives. This report can be used to evaluate the strengths and weaknesses of the program and identify where development work should take place.
- Include in the printouts of results possible alternatives for teaching the skills tested. This option will be included after teachers have identified from the materials available what works well with the students.
- Possible terminal input to the system from a building to decrease turnaround time.

The system is currently a very simple one that teachers can use and feel comfortable with. Other similar systems provide much more sophisticated information and reports. We feel that since our computing capabilities are limited, we will begin providing only the bare essentials to determine their usefulness and then expand as more information is needed by the users. This may require us eventually to increase our computing capability.

BOSS BEAVERTON OBJECT SCORING SYSTEM 10/12/76

SSTF STANDARD SURVEY TEST FORM

CLASS AVERAGES

TEACHER: MORRISON
GRADE: 6

CEDAR HILL

COMPREHENSION
LEVEL = 3.2

	N. I.	L. INF	CHAR	MOOD	HUMOR	INFER	C & EF	DR CON
	******	******	******	******	******	******	******	******
CORRECT	75%	71%	90%	80%	46%	87%	78%	85%

VOCABULARY
LEVEL = 3.2

	SHIFT	C CLUE
	******	******
CORRECT	80%	83%

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BEAVERTON SCHOOLS

BUSS BEAVERTON OBJECT SCORING SYSTEM 10/12/76

SSTP STANDARD SURVEY TEST FORM

PASS/FAIL SUMMARY

TEACHER: MORRISON
GRADE: 6

CEDAR HILL

VOCABULARY
LEVEL = 3.2

STUDENT NAME		SHIFT	C CLUB													
[redacted]		A	FAIL	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		T	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		A	FAIL	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]			PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		C	FAIL	FAIL	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		B	PASS	FAIL	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]			FAIL	FAIL	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		C	FAIL	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		C	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		L	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		M	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		A	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		M	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....
[redacted]		F	PASS	PASS	....	....	....	....	....	....	....	....	....	....	....	....

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BOSS BEAVERTON OBJECT SCORING SYSTEM

10/12/76

SSTF STANDARD SURVEY TEST FORM

OBJECTIVE SCORING RESULTS

CEDAR HILL

TEACHER: HORRISON
GRADE: 6

VOCABULARY
LEVEL = 3.2

STUDENT NAME		SHIFT	C CLUB															
			P	C	CR	P	C	CR	P	C	CR	P	C	CR	P	C	CR	P	C	CR
[redacted]	[redacted]	A	4	2	4	3	3	3+												
[redacted]	[redacted]	I	4	4	4+	3	3	3+												
[redacted]	[redacted]	A	4	3	4	3	3	3+												
[redacted]	[redacted]		4	4	4+	3	3	3+												
[redacted]	[redacted]	C	4	2	4	3	1	3												
[redacted]	[redacted]	B	4	4	4+	3	0	3												
[redacted]	[redacted]		4	0	4	3	1	3												
[redacted]	[redacted]	C	4	2	4	3	3	3+												
[redacted]	[redacted]	C	4	4	4+	3	3	3+												
[redacted]	[redacted]	L	4	4	4+	3	3	3+												
[redacted]	[redacted]	M	4	4	4+	3	3	3+												
[redacted]	[redacted]	A	4	4	4+	3	3	3+												
[redacted]	[redacted]	R	4	4	4+	3	3	3+												
[redacted]	[redacted]	F	4	4	4+	3	3	3+												

+=PASS P=POSSIBLE C=CORRECT CR=CRITERION TO PASS

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SHORT FORM--SCIENCE 1 TEST 9/ 6/76
SAMPLE DATA FOR OBJECT

FAIN MERRI L

TOTAL	1 1.1	2 4.1	3 5.1	4 5.2	5 6.2	6 8.1
10	2	2	3	3	3	1
75%	67%	67%	100%	100%	100%	33%

7 10.1	8 13.1
2	2
67%	67%

FARNELL VICKY A

TOTAL	1 1.1	2 4.1	3 5.1	4 5.2	5 6.2	6 8.1
11	1	0	3	3	1	1
46%	33%	0%	100%	100%	33%	33%

7 10.1	8 13.1
1	1
33%	33%

GOFF SHARONM

TOTAL	1 1.1	2 4.1	3 5.1	4 5.2	5 6.2	6 8.1
5	1	1	1	0	0	1
21%	33%	33%	33%	0%	0%	33%

7 10.1	8 13.1
0	1
0%	33%

SUMMARY 15 STUDENTS

TOTAL	1 1.1	2 4.1	3 5.1	4 5.2	5 6.2	6 8.1
11.9	1.5	0.9	1.7	1.8	1.3	1.3
49%	51%	29%	56%	60%	44%	44%

7 10.1	8 13.1
1.5	1.9
49%	62%

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USE NO. 2 PENCIL

STANDARD INDIVIDUAL TEST FORM

STUDENT NAME | GRADE

TEACHER | SCHOOL

STUDENT NUMBER

PAGE NO.

FOR COMPUTER CENTER ONLY

TEST FORM

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DATE | TEST NO.

DATE | TEST NO.

DATE | TEST NO.

DATE | TEST NO.

DATE | TEST NO.

DATE | TEST NO.

USE NO. 2 PENCIL

STANDARD SURVEY TEST FORM

STUDENT NAME | GRADE

TEACHER | GENDER

STUDENT NUMBER

PAGE NO.

TEST LEVEL

FOR COMPUTER CENTER ONLY

TEST FORM

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I

1	A	B	C	D	E	6	A	B	C	D	E	11	A	B	C	D	E	16	A	B	C	D	E	21	A	B	C	D	E	26	A	B	C	D	E	31	A	B	C	D	E	36	A	B	C	D	E
2	A	B	C	D	E	7	A	B	C	D	E	12	A	B	C	D	E	17	A	B	C	D	E	22	A	B	C	D	E	27	A	B	C	D	E	32	A	B	C	D	E	37	A	B	C	D	E
3	A	B	C	D	E	8	A	B	C	D	E	13	A	B	C	D	E	18	A	B	C	D	E	23	A	B	C	D	E	28	A	B	C	D	E	33	A	B	C	D	E	38	A	B	C	D	E
4	A	B	C	D	E	9	A	B	C	D	E	14	A	B	C	D	E	19	A	B	C	D	E	24	A	B	C	D	E	29	A	B	C	D	E	34	A	B	C	D	E	39	A	B	C	D	E
5	A	B	C	D	E	10	A	B	C	D	E	15	A	B	C	D	E	20	A	B	C	D	E	25	A	B	C	D	E	30	A	B	C	D	E	35	A	B	C	D	E	40	A	B	C	D	E

II

41	A	B	C	D	E	46	A	B	C	D	E	51	A	B	C	D	E	56	A	B	C	D	E	61	A	B	C	D	E	66	A	B	C	D	E	71	A	B	C	D	E	76	A	B	C	D	E
42	A	B	C	D	E	47	A	B	C	D	E	52	A	B	C	D	E	57	A	B	C	D	E	62	A	B	C	D	E	67	A	B	C	D	E	72	A	B	C	D	E	77	A	B	C	D	E
43	A	B	C	D	E	48	A	B	C	D	E	53	A	B	C	D	E	58	A	B	C	D	E	63	A	B	C	D	E	68	A	B	C	D	E	73	A	B	C	D	E	78	A	B	C	D	E
44	A	B	C	D	E	49	A	B	C	D	E	54	A	B	C	D	E	59	A	B	C	D	E	64	A	B	C	D	E	69	A	B	C	D	E	74	A	B	C	D	E	79	A	B	C	D	E
45	A	B	C	D	E	50	A	B	C	D	E	55	A	B	C	D	E	60	A	B	C	D	E	65	A	B	C	D	E	70	A	B	C	D	E	75	A	B	C	D	E	80	A	B	C	D	E

III

81	A	B	C	D	E	86	A	B	C	D	E	91	A	B	C	D	E	96	A	B	C	D	E	101	A	B	C	D	E	106	A	B	C	D	E	111	A	B	C	D	E	116	A	B	C	D	E
82	A	B	C	D	E	87	A	B	C	D	E	92	A	B	C	D	E	97	A	B	C	D	E	102	A	B	C	D	E	107	A	B	C	D	E	112	A	B	C	D	E	117	A	B	C	D	E
83	A	B	C	D	E	88	A	B	C	D	E	93	A	B	C	D	E	98	A	B	C	D	E	103	A	B	C	D	E	108	A	B	C	D	E	113	A	B	C	D	E	118	A	B	C	D	E
84	A	B	C	D	E	89	A	B	C	D	E	94	A	B	C	D	E	99	A	B	C	D	E	104	A	B	C	D	E	109	A	B	C	D	E	114	A	B	C	D	E	119	A	B	C	D	E
85	A	B	C	D	E	90	A	B	C	D	E	95	A	B	C	D	E	100	A	B	C	D	E	105	A	B	C	D	E	110	A	B	C	D	E	115	A	B	C	D	E	120	A	B	C	D	E

IV

121	A	B	C	D	E	126	A	B	C	D	E	131	A	B	C	D	E	136	A	B	C	D	E	141	A	B	C	D	E	146	A	B	C	D	E	151	A	B	C	D	E	156	A	B	C	D	E
122	A	B	C	D	E	127	A	B	C	D	E	132	A	B	C	D	E	137	A	B	C	D	E	142	A	B	C	D	E	147	A	B	C	D	E	152	A	B	C	D	E	157	A	B	C	D	E
123	A	B	C	D	E	128	A	B	C	D	E	133	A	B	C	D	E	138	A	B	C	D	E	143	A	B	C	D	E	148	A	B	C	D	E	153	A	B	C	D	E	158	A	B	C	D	E
124	A	B	C	D	E	129	A	B	C	D	E	134	A	B	C	D	E	139	A	B	C	D	E	144	A	B	C	D	E	149	A	B	C	D	E	154	A	B	C	D	E	159	A	B	C	D	E
125	A	B	C	D	E	130	A	B	C	D	E	135	A	B	C	D	E	140	A	B	C	D	E	145	A	B	C	D	E	150	A	B	C	D	E	155	A	B	C	D	E	160	A	B	C	D	E

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